Closing the gap between Musiasem and S. Pauliuk's socio-economic metabolism accounting framework

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This communication is an outcome of a Musiasem winter school led by Mario Giampietro in Grenoble, France, in December 2023.

Musiasem (multi-scale integrated assessment of societal and ecosystem metabolism) is a framework developped around Mario Giampietro and Kozo Mayumi based on the work of Nicholas Georgescu-Roegen. Musiasem deploys "fund-flow" models (as opposed to the stock-flow models of MFA), where funds are "used and maintained but not consumed as a stock would be when making use of it" [1]. Musiasem describes the system with different levels of detail (scales), which can be assessed in different units. The "macroscope" deals with the way the productive system is organized to satisfy final demand. The "mesoscope" deals with trade with the rest of the world. The "microscope" deals with environmental pressures generated by the system.

Pauliuk et al. [2] proposed a generic accounting structure for socio-metabolic analyses and showed that the MFA, LCA and IO methods can be expressed in this structure, that is, in the form of Supply and Use Tables (SUT). The SUT distinguish products, waste, production factors (e.g. labour), natural resources, emissions.

The goal of the communication is to facilitate the understanding and handling of Musiasem for the SEM community. For this, we will present an example showing how Musiasem can also be expressed in the SUT framework mentioned above. It relies on three principles: (i) for production factors and natural resources, distinguish between flows taken from stocks and funds (e.g., arable land, human work), (ii) add aggregation levels for products and industries in order to easily move from macroscope to mesoscope or microscope, (iii) use SUT layers to express the flows in different units that are suited for different purposes (e.g., food consumption expressed in proteins and energy while trade of food commodities expressed in raw mass).

We hope this will help spread some key features emphasized in Musiasem case studies such as the analysis of flow/fund ratios to characterize metabolic patterns of societies, or the analysis grid in terms of viability (internal coherence) / feasibility (external coherence) / desirability (expectations of the population).

References:

[1] Gerber, J. F., & Scheidel, A. (2018). In search of substantive economics: Comparing today's two major socio-metabolic approaches to the economy–MEFA and MuSIASEM. Ecological Economics, 144, 186-194.

[2] Pauliuk, S., Majeau-Bettez, G., & Müller, D. B. (2015). A general system structure and accounting framework for socioeconomic metabolism. Journal of Industrial Ecology, 19(5), 728-741.